

FORM PTO-1390
(REV. 5-93)U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICEATTORNEY'S DOCKET NUMBER
2345/137TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)

09/673520

INTERNATIONAL APPLICATION NO.
PCT/EP99/01284INTERNATIONAL FILING DATE
28 October 1999
(28.10.99)PRIORITY DATE CLAIMED
17 April 1998
(17.04.98)

TITLE OF INVENTION

METHOD FOR UTILIZING DIGITAL DATA NETWORKS FOR THE TRANSMISSION OF DATA VIA VOICE CONNECTION PATHS

APPLICANT(S) FOR DO/EO/US

DASSOW, Heiko; and ZEFFLER, Klaus

Applicant(s) herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) immediately rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). (two)
10. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included
13. ☒ A **FIRST** preliminary amendment.
☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☒ A substitute specification.
15. ☐ A change of power of attorney and/or address letter
16. ☒ Other items or information: Marked-up specification, International Search Report and International Preliminary Examination Report

09/673520

INTERNATIONAL APPLICATION NO
PCT/EP99/01284

ATTORNEY'S DOCKET NUMBER
2345/137

☒ The following fees are submitted:

Basic National Fee (37 CFR 1.492(a)(1)-(5)):

Search Report has been prepared by the EPO or JPO \$860.00

International preliminary examination fee paid to USPTO (37 CFR 1.482) ... \$690.00

No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) \$710.00

Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$1,000.00

International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) \$100.00

CALCULATIONS | PTO USE ONLY

528 Rec'd PCT/PTO 17 OCT 2000

ENTER APPROPRIATE BASIC FEE AMOUNT =

\$ 860.00

Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).

\$

Claims

Number Filed

Number Extra

Rate

Total Claims

12 - 20 =

0

X \$18.00

\$

Independent Claims

1 - 3 =

1

X \$80.00

\$

Multiple dependent claim(s) (if applicable)

+ \$270.00

\$

TOTAL OF ABOVE CALCULATIONS =

\$860.00

Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28).

\$

SUBTOTAL =

\$

Processing fee of \$130.00 for furnishing the English translation later the ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).

\$

TOTAL NATIONAL FEE =

\$ 860.00

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property

\$

TOTAL FEES ENCLOSED =

\$ 860.00

Amount to be:
refunded

\$

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a. ☐ A check in the amount of \$_____ to cover the above fees is enclosed.

b. ☒ Please charge my Deposit Account No. 11-0600 in the amount of \$860.00 to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 11-0600. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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SIGNATURE

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NAME

DATE

10/17/00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT: DASSOW, et al.
SERIAL NO.: to be assigned
FILED: herewith
TITLE: METHOD FOR UTILIZING DIGITAL DATA NETWORKS FOR
THE TRANSMISSION OF DATA VIA VOICE CONNECTION
PATHS
ART UNIT: not yet known
EXAMINER: not yet known

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

PRELIMINARY AMENDMENT

Please amend the above-identified application before a first consideration on the merits as follows:

IN THE TITLE

Please amend the title to read --METHOD FOR USING DIGITAL DATA NETWORKS FOR THE TRANSMISSION OF DATA VIA VOICE CONNECTION PATHS--.

IN THE DRAWINGS

Please replace figures 1 and 2 with amended figures 1 and 2 submitted herewith.

IN THE SPECIFICATION

Please replace the specification of record, i.e., the English translation of the PCT application text (submitted herewith) with the substitute specification submitted herewith. The substitute specification is being submitted due to the nature and number of amendments. A marked-up copy of the substitute specification is also submitted herewith, in accordance with 37 C.F.R. 1.125(b). It is respectfully submitted that the substitute specification contains no new matter.

On page 14, line 1, of the specification of record change "Patent Claims" to --WHAT IS CLAIMED IS:--.

IN THE CLAIMS

Please cancel without prejudice claims 1-10, as well as the substitute claims 1-9 annexed to the International Preliminary Examination Report, and add new claims 11-22 as follows:

--11. (new) A method for reducing bandwidth when transmitting data between a sending terminal and a receiving terminal over a voice connection path using a digital data network, the method comprising:

converting, within the digital data network, a coding of user information of the transmitted data between a data transmission in the voice connection path and a data transmission in the digital data network so as to transmit the user information via the coded voice connection path on at least one first section of the digital data network and transmit the user information by a method suitable for the digital data network on at least one second section of the digital data network.

12. (new) The method as recited in claim 11 wherein the sending and the receiving terminals use a similar modulation method for transmitting the data over the voice connection path.

13. (new) The method as recited in claim 11 wherein no special functional matching of the sending and receiving terminals is required for the converting.

14. (new) The method as recited in claim 11 wherein no special adaptation of the sending and receiving terminals to transmission characteristics of the digital data network is required for the transmission of the user information.

15. (new) The method as recited in claim 11 wherein the transmitting the user information via the coded voice connection path on at least one first section of the digital data network is performed automatically by a context-related call-number translation during a connection setup so as not to be perceived by the sending and receiving terminals.

16. (new) The method as recited in claim 15 wherein the transmitting the user information via the coded voice connection path on at least one first section of the digital data network is performed such that end-to-end signaling of the sending and receiving terminals for a sending/receiving terminal control of the data transmission is terminated at a transition into the digital data network and is newly generated so as to integrate a control of the data transmission by the digital data network into the end-to-end signaling.

17. (new) The method as recited in claim 11 wherein the sending and receiving terminals use different respective data transmission processes and further comprising temporarily storing and converting the transmitted data and signaling information so as to match the respective data transmission processes of the sending and receiving terminals such that differences in the respective data transmission processes are not perceived by the sending and receiving terminals.

18. (new) The method as recited in claim 11 further comprising splitting the user information into data packets for the transmitting over the digital data network, a transmission rate of the data packets being flexibly adapted at a network transition to a bit rate transmitted by the sending terminal.

19. (new) The method as recited in claim 11 wherein at least one of the sending and receiving terminals is connected directly or via a digital transmission link to the digital data

network so as to avoid a need to first code the data using either of the sending and receiving terminal for the data transmitting over the voice connection path and then a need to decode the coded data.

20. (new) The method as recited in claim 11 wherein the digital data network includes an interconnection of a plurality of individual data networks.

21. (new) The method as recited in claim 11 wherein the user information to be transmitted conforms to features of FAX class 3.

22. (new) The method as recited in claim 11 further comprising, before the transmitting over the digital data network, protecting the data by cryptographic processes against passive monitoring, alteration and/or simulation of incorrect call data and/or contents.--.

IN THE ABSTRACT

Please delete the abstract of record and replace it with the following amended abstract:
--A method for reducing bandwidth when transmitting data between a sending terminal and a receiving terminal over a voice connection path using a digital data network. The coding of user information is converted within the digital data network between data transmission in the voice connection path and data transmission in the digital data network so that the user information is transmitted on one section of the digital data network via the coded voice connection path and the user information is transmitted on another section of the digital data network using a method suitable for the digital data network.--.

REMARKS

This Preliminary Amendment cancels original claims 1-10, as well as the substitute claims 1-9 annexed to the International Preliminary Examination Report (translation submitted herewith), and adds new claims 11-22. The new claims do not add new matter to the application but do conform the claims to U.S. Patent and Trademark Office rules.

The amendments to the specification, abstract and drawings are to conform the specification, abstract and drawings to U.S. Patent and Trademark Office rules. It is

respectfully submitted that the amendments to the specification, abstract and drawings do not introduce new matter into the application.

The underlying PCT application includes a Search Report, a copy of which is included herewith.

Conclusion

Consideration of the present application as amended is hereby respectfully requested.

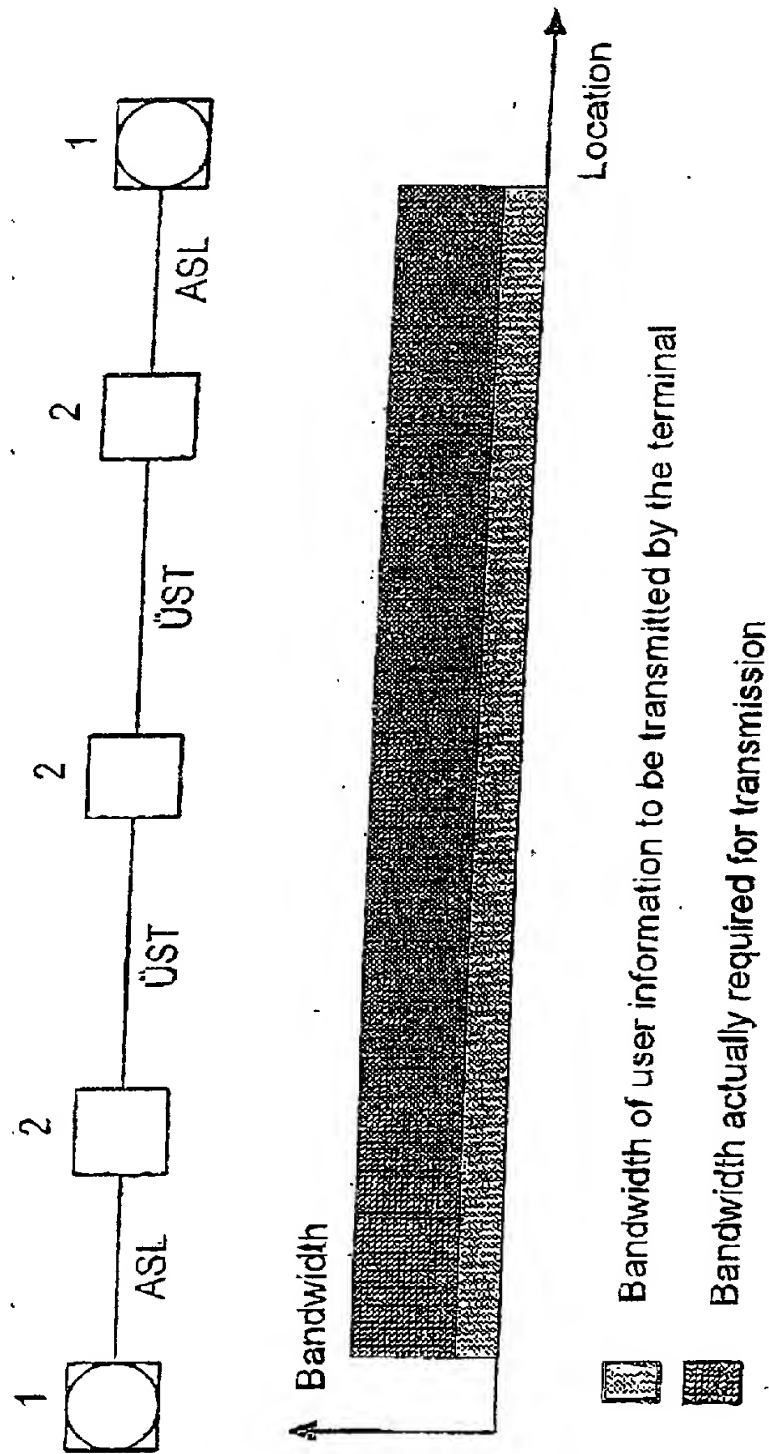
Respectfully Submitted,

Kenyon & Kenyon

Dated: 10/12/00

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PRIOR ART

Fig. 1

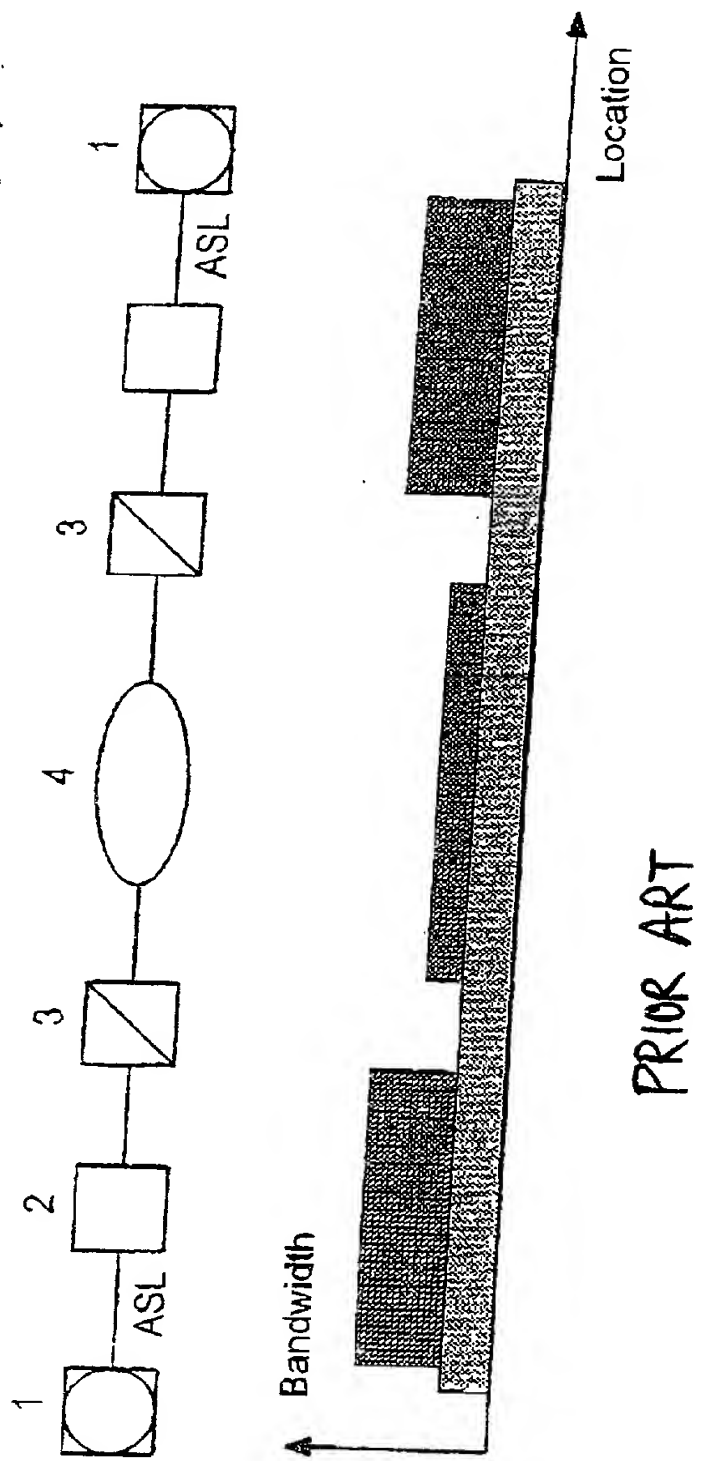


Fig. 2

S/PRTS

[2345/137]

METHOD FOR USING DIGITAL DATA NETWORKS FOR THE
TRANSMISSION OF DATA VIA VOICE CONNECTION PATHS

Field of the Invention

The present invention relates generally to a method for using digital data networks, and in particular, to a method for reducing bandwidth when transmitting data between a sending terminal and a receiving terminal over a voice connection path using a digital data network.

5

Related Technology

For the purpose of data transmission, communication networks exist which are used exclusively for transmitting digitally coded data (data, voice, tone signals, images) between terminals, and which have been suitably optimized for this application purpose.

10

Owing to the limited worldwide availability of such networks, even today a multitude of data is still transmitted over analog voice connection paths. In this case, modulators and demodulators (MODEMs) are used to adapt the binary-coded data to the analog transmission characteristics of the voice connection paths.

15

As a result of the growth of data networks, especially of the data network known as the INTERNET for the worldwide interconnection of computer networks, methods have also become established which transmit speech in coded form over data networks.

20

Due to the now far-advanced digitization of analog telecommunications networks, hardly any pure analog, i.e., exclusively analog, voice connection paths remain. Today, generally only the subscriber access line is operated in analog manner, while

the long-distance transmission of the voice information is carried out using digital transmission methods. Normally, a transmission rate of 64 kbit/s is used in telecommunications networks for an analog voice transmission path standardized according to CCITT (Comité Consultative International Télégraphique et
5 Téléphonique - International Advisory Committee for Telegraph and Telephone Services). The most well-known systems for wire-bound voice transmission are PDH (Plesiosynchronous Digital Hierarchy - standardized system for digital data transmission), SDH (Synchronous Digital Hierarchy - international standard for synchronous transmission networks) and ATM (Asynchronous Transfer Mode -
10 digital transmission method, e.g., for broadband ISDN, in which the entire capacity of a transmission channel is split, depending on demand and time, between a few or many connections which then use the channel jointly). For wireless transmission of speech in mobile communication networks, use is made of the DECT standard (Digital Enhanced (European) Cordless Telecommunication - uniform digital standard
15 for cordless telephones, wireless telecommunications systems and wireless LANs in Europe) as well as of the GSM standard (Global Systems for Mobile Communication - worldwide mobile communication standard for digital, cellular mobile communication networks). Likewise, there has recently been discussion about voice transmission over the Internet, as indicated in the magazine iX in August 1997, page
20 32.

Even if the voice connection path is set up by these technical processes, the full bandwidth of the voice channel of, for example, 64 kbit/s must be transmitted for a narrowband (low-bit-rate) data transmission over such a voice connection path. This
25 is necessary so that the receiving data terminal will be able to decode the original data from the voice channel. This means that the theoretically possible useful data rate of a digital transmission link over which the low-bit-rate data must be transmitted is not fully utilized. However, this is very disadvantageous when the transmission capacity thus utilized is particularly expensive, as is the case, for example, with satellite
30 connections or overseas cables.

Owing to the already existing multifunctional digital networks, it is likewise possible to transmit data and voice using the same system resources. In this case, it is no longer necessary to use a voice connection path for data transmission between two terminal systems. Therefore, the full bandwidth of the digital data connection can be used for transmitting the user information, i.e., the information desired to be transmitted from one of the terminal systems. However, this method requires that both terminals be directly connected to the multifunctional network, and that both terminals have been technically prepared for this type of data transmission.

Group 3 facsimile transmission (FAX) is typical of a multitude of applications for data transmission over voice connection paths. In this case, the voice connection path of a dialed telecommunications connection is used for transmitting image information. Although there is also a FAX Group 4 variant which is capable of transmitting the image information over the multifunctional ISDN network without using analog voice connection paths, this variant is presently still very little used, so that most Group 4 FAX machines are downward-compatible with Group 3.

Likewise known is a method in which the FAX user information is not directly printed as an image at the communication endpoint, but is temporarily stored in digital form in an electronic data processing system (EDP), as indicated in the magazine iX in August 1997 on page 35. In this case, the digital data processing system is used for the manual or automatic relay of the FAX user information to a dedicated workstation or for archiving and logging the information sent and received.

The details of this method, known as "FAX by e-mail", are described more fully in a study "WIDE Message-based Fax over the Internet" by Kiyoshi Toyoda et al. from the WIDE Project in Application Area, INTERNET-DRAFT, July 1997, pages 1 to 5.

Further known in this connection is the automatic further processing of the FAX information in the receiving data processing system, as shown by an example

(German Patent Application P 9538 entitled "*Verfahren zur Verteilung von Fax-Dokumenten über ein EDV-System*" [Method for Distributing Fax Documents Via an EDP System].

5 In addition, various methods already exist which permit the conversion of the FAX modulation into a data modulation. In a method according to U.S. Patent 5,513,212, this conversion is only carried out exclusively for the purpose of the simultaneous transmission of FAX and voice modulation with the aid of so-called SVD modulation. This publication contains no suggestion whatsoever for the digital transmission of
10 data with the aim of bandwidth reduction.

Another method, described in a study "Requirements for Internet Fax" by Larray Masinter from the Xerox Corp. in "Application Area INTERNET-DRAFT", dated Nov. 4, 1997, pages 1 to 4, employs a digital network to transmit the originally
15 analog-modulated information in digital form between two converting modems which, functionally, must be disposed directly at the transition into the data network.

All these known methods suffer from the serious disadvantage that they are limited only to the transition between various services and to the conversion of individual
20 services handled via a voice connection in the voice connection path.

World Patent Document No. WO 97/47107 discloses a method and a device for connecting a fax machine to a digital communication network. In order to be able to transmit a fax message from one fax machine to another using digital communication,
25 an interface which converts the fax message to be transmitted into an image data file is allocated to each fax machine. The image data file is subsequently transmitted via an analog line or an ISDN line of a public, circuit-switched network or a private telephone line to a server. In the server, the image data file is embedded into a data file and is supplied to a data path of a data network.

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Summary of the Invention

Therefore, an object of the present invention is to provide a method for avoiding the problems, discussed above, with regard to the transmission bandwidth of known methods which make no contribution to reducing the transmission paths used for transmitting user information.

The problem of reducing bandwidth when transmitting data over voice connection paths routed in a digital data network is solved by the present invention, in that both the sending and the receiving terminals use a similar method for transmitting data in voice connection paths, but the user information to be transmitted (i.e., the information that is desired to be transmitted from a terminal) is transported in one or more sections via a data network, the modulation method specified by the terminal not being used over the entire transmission link in direct manner via one or more switching nodes or in indirect manner via a data network. Rather a conversion of the coding of the user information between the data transmission in the digitally transmitting voice connection path and the data transmission in the digital data network is first carried out within the data network, so that on some sections of the data network, the user information is transmitted via the coded voice connection path, and on the other sections of data network, the user information is transmitted by a method suitable for digital data networks. There is no need for special functional matching of the terminals or for the terminals to be specially adapted to the transmission characteristics of the digital data network for the transmission of the user information.

In an embodiment of the method according to the present invention, the inclusion of a digital data network in the voice connection path used for data transmission is effected automatically by a context-related call-number translation during the connection setup, this not being perceived by the terminals using the voice connection path.

Furthermore, the digital data network is included in the voice connection path used for

voice transmission in such a way that the end-to-end signaling of the terminals,
required for the control of data transport, is terminated at the transition into the digital
data network used for transmission and is newly generated in order to thus integrate
the control of the data transport by the digital data network into this end-to-end
5 signaling.

Moreover, there is suitable temporary storage and conversion of the transmitted data
and signaling information, so that different methods of the terminals involved in the
data transmission can be used.

10

Another embodiment of the method according to the present invention provides for
the user information to be split into small data packets for its transmission over the
digital data network, and thus to be flexibly adapted to the bit rate actually being
transmitted by the terminal.

15

The method according to the present invention further provides that at least one of the
terminals be connected directly or via a digital transmission link to the digital data
network, with the result that the data need not first be coded by the terminal for
transmission in the voice connection path and then decoded again.

20

The method according to the present invention may be implemented in a data network
which is an individual data network or which is made up of an interconnection of a
plurality of individual data networks.

25

The user information to be transmitted may in an embodiment of the method
according to the present invention conform to the features of FAX class 3.

30

In another embodiment of the method according to the present invention, using
cryptographic processes the user information in the digital data network is protected
against passive monitoring, alteration and/or simulation of incorrect call data and/or

contents.

The method according to the present invention permits what is not possible with the previously known methods, namely, to dispose the devices required for conversion at central locations of the data network and, therefore, not to have to provide such a conversion at every transition from a conventional voice connection path and a digital data network.

Consequently, it may be of great advantage that, according to the problem of bandwidth reduction solved by the present invention, the long-distance transmission of the user information now requires only the bandwidth which the terminal actually requires for the transmission of the information. In the case of a FAX Group 3 connection at the presently customary 14400 bit/s, therefore, only slightly more than 14400 bit/s is actually required for transmission, instead of the usual 64 kbit/s (e.g. in the ISDN D-channel), for coding in the voice channel. This corresponds approximately to a reduction of the required bandwidth to 1/4 of the original capacity. The digital transmission of the user information over any data network can be so integrated into the connection that the participating terminals are unable to detect whether the transmission is being effected completely via a voice connection path or whether the transmission is being effected partially via an independent data network. This also ensures that, as is generally customary in the case of FAX services, the successful termination of the connection is acknowledged.

It may be that the use of data networks for the delayed forwarding of the information has been used when working with EDP-supported switching of FAX information; there, however, the FAX switching represents an end point for the acknowledged FAX transmission and is not used for the transparent transmission of the FAX information. Consequently, in contrast to a method according to the present invention, a true end-to-end acknowledgment of the successful transmission of the FAX information is then not possible.

A further advantage of the present invention can be seen in that, in contrast to the already known use of data networks for the real-time transmission of FAX information, the method according to the present invention can be implemented significantly more cost-effectively. Thus, using the present invention, the conversion from data modulation in the voice connection path to data transmission in the data network can be effected at a central location of the data network. Consequently, depending on the limiting condition, it is possible to decide individually for each connection whether, for one or more sections, data transmission in the voice connection path is to be converted or not. In the case of connections using only transmission links having sufficiently great transmission reserves, the more cost-effective solution might be to transmit the data in the voice connection path routed via a data network, without additional conversion. If, however, long sections have to be routed over heavily loaded transmission links of the data network, then the data transmission conversion implemented by the method according to the present invention can significantly reduce the data rate on the heavily loaded sections.

Brief Description of the Drawings

Hereinbelow, the present invention is elaborated upon on the basis of the drawings, in which:

- Figure 1 shows a schematic representation of a prior art basic structure of data transmission in voice connection paths, including a graphical representation of the required transmission bandwidth;
- Figure 2 shows a schematic representation of a prior art method for a service-specific utilization of a data network, including a graphical representation of the required transmission bandwidth;
- Figure 3 shows a schematic representation of an embodiment of the method according to the present invention, including a graphical representation of the required transmission bandwidth;
- Figure 4 shows a simplified schematic representation of information transmission; and

Figure 5 shows a simplified schematic representation of a network implemented in accordance with an embodiment of the method according to present invention.

5 Detailed Description

Figure 1 shows a schematic representation of a prior art basic structure of data transmission in voice connection paths. The two terminals 1 are connected via an access line ASL to one of a plurality of exchanges 2. These exchanges are interconnected via voice connection paths ÜST. In order to set up a connection, usually one of the two terminals 1 sends its destination information to the corresponding exchange 2 which thereupon sets up a voice connection path ÜST between the two terminals 1. Owing to their technical construction, both terminals 1 are capable of coding the data for transmission in such a manner that it can be transmitted via a voice connection path. Such coding is based normally on multi-frequency tone signals of the kind known, for example, from multi-frequency tone dialing.

Usually, at the beginning of the connection, both terminals 1 test the characteristics of the voice connection path ÜST and of their own device type, in order then to agree interactively on a transmission method which makes optimal use of the voice connection path. However, in determining the transmission method, it is virtually irrelevant how the individual transmission links ASL, ÜST and exchanges 2 involved in the connection are actually technically implemented, i.e., whether, for example, the transmission and switching in a certain section are analog or digital.

25 To illustrate the transmission bandwidth required in the individual sections ASL, ÜST of the transmission link, the transmission bandwidth actually required in each case is shown below the end-to-end connection in the bottom part of Figure 1, and likewise in Figures 2 and 3; in the example shown in Figure 1, an exclusively digital transmission method and digital switching for the voice connection path have been assumed.

Figure 2 shows a known transmission method for FAX information. As already described in connection with Figure 1, terminal 1 sends data via a voice connection path which is made available by way of its access line ASL and assigned exchange 2.

5 Unlike in the straight-through voice connection path shown in Figure 1, a data network 4 is used for transmitting the user information. At transition 3 into data network 4, the voice connection path is terminated and the data transmitted therein is routed directly via data network 4 to assigned transition 3, from where data is then transmitted again via a voice connection path.

10

In this connection, however, it should be mentioned that, within data network 4, the bandwidth required for information transmission is only slightly higher than the user information sent by the terminal, as is indicated in the bottom part of Figure 2, as well. However, it should also be emphasized that, in this example, the voice connection path is not routed via data network 4, but is terminated at transition 3 and is newly generated, so that in none of the transmission-path sections used here is the voice connection path transmitted via a digital data network, something which is, however, needed for a method according to the present invention as described in the following, because an object of the present invention is to save on transmission bandwidth during transmission via a digital data network.

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In an embodiment of the method according to the present invention, for the transition from the voice connection path to the data network, use is advantageously made not of special modems adapted to the type of voice transmission, but of the normal telephone gateways for voice traffic.

25

The actual transition from data transmission in the voice connection path to transmission in the digital data network may advantageously take place at several central locations in the data network, as roughly indicated in Figure 5. Thus, the transition between transmission in the digitally routed voice connection path and data

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transport in the data network can be flexibly realized, and the voice connection paths can be connected to the data network by already existing devices which need not be modified to suit the method according to the present invention.

5 An embodiment of the method according to the present invention is illustrated in Figure 3. A voice connection path begins at a terminal 1 and, as also in the two previously described prior methods, is routed via an access line ASL and one or (not shown) more exchanges 2. In contrast to the known method shown in Figure 2, in this case the voice connection path is not terminated at a transition 5 to a data network 4,
10 but the entire voice connection path, including the user information modulated therein, is routed in data network 4. The slightly greater bandwidth requirement in comparison with the pure voice connection path results from the additional control information which is always required in a data network. The method according to the present invention can be employed within this routing of the voice connection path in the data
15 network, and the user information modulated in the voice connection path can be converted at transition 6 between the end of one data network 4 and the start of the next data network 7 used for transmission, and can be transmitted directly over the aforementioned next data network 7.

20 In an embodiment, the method according to the present invention can be integrated particularly simply into an existing data network if the inclusion of the data network in the voice connection path used for data transmission, as well as the inclusion of transmission sections operated using the method according to the present invention, are accomplished automatically by context-related call-number translation.

25 Call-number translation is possible either if the terminal setting up the connection also sends an identifier for the desired service, e.g., FAX, or if information concerning which access line will be used exclusively for data transmission in the voice connection path is stored in the exchange assigned to the terminal. In this case, no
30 special call number needs to be dialed when setting up the connection to ensure that

data transmission in the voice connection path is replaced by data transmission in the data network. This is accomplished automatically by the aforementioned call-number translation in the telecommunications network.

5 A problem relating to the acknowledgment of the transmitted data may be solved by another embodiment of the method according to the present invention. Namely, when data is transmitted via a voice connection path, only an end-to-end acknowledgment of the transmitted data can be carried out. This results in the disadvantage that, in the event of a faulty transmission of the data, the transmission must be repeated over the
10 entire transmission link. Owing to the section-wise transmission and acknowledgment of the data according to the present invention, the transmission of the data only has to be repeated over the section in which the error actually occurred. Figure 4 shows an example of one possible practical implementation, by which the net data transmission rate is likewise improved.

15 After the voice connection path has been set up between terminal 1 and transition 5 (effected by a modem) between a data (user information) transmission in the voice connection path and a data transmission in the digital data network, the sender identification of terminal 1 is transmitted. For this purpose, it is not necessary that the connection to the other terminal 1 already be completely established. Namely, as soon
20 as the connection sections to the receiving terminal have been set up, the sender identification is transmitted over these sections of the transmission link. Similarly, as shown in Figure 4, the receiver identification is then transmitted in the reverse direction to the sending terminal. The user information is subsequently transmitted and acknowledged section-by-section. The final confirmation of successful
25 transmission is then sent again directly from the receiving terminal to the sending terminal.

30 Since the technical parameters of the two terminals are not necessarily identical or do not have to be identical, it is apparent that different technical methods may be

employed on the respective voice connection paths. Thus, it is possible for the two terminals to send and receive at different bit rates. According to the present invention, this problem is solved in that, at transitions 6 between data transmission in voice connection path 4 and data transmission in digital data network 7, the user data is temporarily stored for a brief time (depending on the speed difference to be compensated) for the purpose of speed matching and, if applicable, time gaps in the data stream are picked up by appropriate signaling.

Since in the case of data transmission in the voice connection path, the maximum possible transmission rate is not always required during the entire duration of the connection, in a further embodiment of a method according to the present invention, the data transfer in digital data network 7 may be effected at a non-constant bit rate and be flexibly adapted to the instantaneous requirements.

If a method according to the present invention for bandwidth reduction in voice connection paths is applied to the transmission of user information according to FAX class 3, particular efficiency is achieved when FAX messages are sent over long distances. Through the arrangement of transitions from FAX transmission in the voice connection path to FAX transmission in a data network available worldwide, such as the Internet or an X.25 network, it is possible to transmit the FAX message over expensive long-distance links at correspondingly reduced bit rate via a data network, while the message is distributed geographically from the transitions to the end user via standard voice connection paths which can be implemented using both conventional techniques and with the aid of digital data networks. It would be sufficient, for example, if in each case one of these transitions were installed in Moscow, Frankfurt, (as shown in Figure 5), New York and Tokyo. For a large proportion of international FAX traffic, it would then no longer be necessary for the data to be transmitted in the voice connection path on intercontinental links.

Instead of establishing a new worldwide data network for the purpose of reducing

bandwidth when transmitting data in the voice connection path, it is possible to utilize the existing INTERNET for this purpose.

5 The bottom part of Figure 3 shows how bandwidth is saved on the expensive long-distance links which are implemented by digital data networks 7.

10 Since, however, there can be no guarantee in the INTERNET that the data transmitted therein will not be subject to unauthorized access, encryption by cryptographic processes may be employed. In the event that a computer or intelligent terminal is to be employed as a terminal, it is possible, using the appropriate software, to connect the computer or intelligent terminal directly to the digital data network. In this manner, using any personal computer (PC) connected to the INTERNET, it is possible, for example, to send a FAX message to a Group 3 terminal without this requiring any special adaptation of the participating hardware.

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METHOD FOR ~~{UTILIZING}~~ USING DIGITAL DATA NETWORKS FOR THE
TRANSMISSION OF DATA VIA VOICE CONNECTION PATHS

Field of the Invention

The present ~~{The}~~ invention relates generally to a method for using digital data networks ~~{according to the preamble of Claim 1.}~~, and in particular, to a method for reducing bandwidth when transmitting data between a sending terminal and a receiving terminal over a voice connection path using a digital data network.

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Related Technology

For the purpose of data transmission, communication networks exist which are used exclusively for transmitting digitally coded data (data, voice, tone signals, images) between terminals, and which have been suitably optimized for this application purpose.

10

Owing to the limited worldwide availability of such networks, even today a multitude of data is still transmitted over analog voice connection paths. In this case, modulators and demodulators (MODEMs) are used to adapt the binary-coded data to the analog transmission characteristics of the voice connection paths.

15

As a result of the growth of data networks, especially of the data network known as the INTERNET for the worldwide interconnection of computer networks, methods have also become established which transmit speech in coded form over data networks.

20

Due to the now far-advanced digitization of analog telecommunications networks, hardly any pure analog, i.e., exclusively analog, voice connection paths remain. Today, generally only the subscriber access line is operated in analog manner, while

MARKED-UP SPECIFICATION

the long-distance transmission of the voice information is carried out using digital transmission methods. Normally, a transmission rate of 64 kbit/s is used in telecommunications networks for an analog voice transmission path standardized according to CCITT (Comité Consultative International Télégraphique et
5 Téléphonique - International Advisory Committee for Telegraph and Telephone Services). The most well-known systems for wire-bound voice transmission are PDH (Plesiosynchronous Digital Hierarchy - standardized system for digital data transmission), SDH (Synchronous Digital Hierarchy - international standard for synchronous transmission networks) and ATM (Asynchronous Transfer Mode - digital
10 transmission method, e.g., for broadband ISDN, in which the entire capacity of a transmission channel is split, depending on demand and time, between a few or many connections which then use the channel jointly). For wireless transmission of speech in mobile communication networks, use is made of the DECT standard (Digital Enhanced (European) Cordless Telecommunication - uniform digital standard for
15 cordless telephones, wireless telecommunications systems and wireless LANs in Europe) as well as of the GSM standard (Global Systems for Mobile Communication - worldwide mobile communication standard for digital, cellular mobile communication networks). Likewise, there has recently been discussion about voice transmission over the Internet, as indicated in the magazine iX in August 1997, page
20 32.

Even if the voice connection path is set up by these technical processes, the full bandwidth of the voice channel of, for example, 64 kbit/s must be transmitted for a narrowband (low-bit-rate) data transmission over such a voice connection path. This
25 is necessary so that the receiving data terminal will be able to decode the original data from the voice channel. This means that the theoretically possible useful data rate of a digital transmission link over which the low-bit-rate data must be transmitted is not fully utilized. However, this is very disadvantageous when the transmission capacity thus utilized is particularly expensive, as is the case, for example, with satellite
30 connections or overseas cables.

Owing to the already existing multifunctional digital networks, it is likewise possible to transmit data and voice using the same system resources. In this case, it is no longer necessary to use a voice connection path for data transmission between two terminal systems. Therefore, the full bandwidth of the digital data connection can be used for transmitting the ~~[useful information]~~ user information, i.e., the information desired to be transmitted from one of the terminal systems. However, this method requires that both terminals be directly connected to the multifunctional network, and that both terminals have been technically prepared for this type of data transmission.

Group 3 facsimile transmission (FAX) is typical of a multitude of applications for data transmission over voice connection paths. In this case, the voice connection path of a dialed telecommunications connection is used for transmitting image information. Although there is also a FAX Group 4 variant which is capable of transmitting the image information over the multifunctional ISDN network without using analog voice connection paths, this variant is presently still very little used, so that most Group 4 FAX machines are downward-compatible with Group 3.

Likewise known is a method in which the FAX ~~[useful]~~ user information is not directly printed as an image at the communication endpoint, but is temporarily stored in digital form in an electronic data processing system (EDP), as indicated in the magazine iX in August 1997 on page 35. In this case, the digital data processing system is used for the manual or automatic relay of the FAX ~~[useful]~~ user information to a dedicated workstation or for archiving and logging the information sent and received.

The details of this method, known as "FAX by e-mail", are described more fully in a study "WIDE Message-based Fax over the Internet" by Kiyoshi Toyoda et al. from the WIDE Project in Application Area, INTERNET-DRAFT, July 1997, pages 1 to 5.

Further known in this connection is the automatic further processing of the FAX

information in the receiving data processing system, as shown by an example
(German Patent Application P 9538 entitled "*Verfahren zur Verteilung von
Fax-Dokumenten über ein EDV-System*" [Method for Distributing Fax Documents
Via an EDP System]).

5

In addition, various methods already exist which permit the conversion of the FAX
modulation into a data modulation. In a method according to U.S. Patent 5,513,212,
this conversion is only carried out exclusively for the purpose of the simultaneous
transmission of FAX and voice modulation with the aid of so-called SVD modulation.

10 This publication contains no suggestion whatsoever for the digital transmission of
data with the aim of bandwidth reduction.

Another method, described in a study "Requirements for Internet Fax" by Larray
Masinter from the Xerox Corp. in "Application Area INTERNET-DRAFT", dated
15 Nov. 4, 1997, pages 1 to 4, employs a digital network to transmit the originally
analog-modulated information in digital form between two converting modems which,
functionally, must be disposed directly at the transition into the data network.

All these known methods suffer from the serious disadvantage that they are limited
20 only to the transition between various services and to the conversion of individual
services handled via a voice connection in the voice connection path.

World Patent Document No. WO 97/47107 discloses a method and a device for
connecting a fax machine to a digital communication network. In order to be able to
25 transmit a fax message from one fax machine to another using digital communication,
an interface which converts the fax message to be transmitted into an image data file
is allocated to each fax machine. The image data file is subsequently transmitted via
an analog line or an ISDN line of a public, circuit-switched network or a private
telephone line to a server. In the server, the image data file is embedded into a data
30 file and is supplied to a data path of a data network.

Summary of the Invention

Therefore, an ~~[Therefore, the]~~ object of the present invention is to ~~[indicate a design approach for eliminating]~~ provide a method for avoiding the problems, discussed ~~[extensively]~~ above, with regard to the transmission bandwidth of known methods which make no contribution to reducing the transmission paths used for transmitting ~~[useful]~~ user information.

The problem of reducing bandwidth when transmitting data over voice connection paths routed in a digital data network is solved by the present invention, in that both the sending and the receiving terminals use a ~~[generally identical]~~ similar method for transmitting data in voice connection paths, but the ~~[useful]~~ user information to be transmitted (i.e., the information that is desired to be transmitted from a terminal) is transported in one or more sections via a data network, the modulation method specified by the terminal not being used over the entire transmission link in direct manner via one or more switching nodes or in indirect manner via a data network~~], but rather]~~. Rather a conversion of the coding of the user information between the data transmission in the digitally transmitting voice connection path and the data transmission in the digital data network [being effected by a modulation method suitable for the] is first carried out within the data network, so that on some sections of the data network, the user information is transmitted via the coded voice connection path, and on the other sections of data network, the user information is transmitted by a method suitable for digital data networks[; it further being the case that there]. There is no need for special functional matching of the terminals or for the terminals to be specially adapted to the transmission characteristics of the digital data network for the transmission of the ~~[useful information.]~~ user information.

~~[As regards the embodiment of this method, the conversion (matching) of the coding of the useful data in the digitally transmitting voice connection path and the data transmission in the digital data network is carried out only within the data network, so that on some line sections of the data network, the useful information is transmitted~~

via the coded voice connection path, and on the other line sections of the data network, the useful information is transmitted directly according to the methods of the data network.

5 ~~According to a further~~ In an embodiment of the method ~~[of]~~ according to the present invention, the inclusion of a digital data network in the voice connection path used for data transmission is effected automatically by a context-related call-number translation during the connection setup, this not being perceived by the terminals using the voice connection path.

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Furthermore, the digital data network is included in the voice connection path used for voice transmission in such a way that the end-to-end signaling of the terminals, required for the control of data transport, is terminated at the transition into the digital data network used for transmission and is ~~[regenerated]~~ newly generated in order to
15 thus integrate the control of the data transport by the digital data network into this end-to-end signaling.

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Moreover, there is suitable temporary storage and conversion of the transmitted data and signaling information, so that different methods of the terminals involved in the data transmission can be used.
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~~[A further embodiment]~~ Another embodiment of the method according to the present invention provides for the ~~[useful]~~ user information to be split into small data packets for its transmission over the digital data network, and thus to be flexibly adapted to
25 the bit rate actually being transmitted by the terminal.

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The method according to the present invention further ~~[proposes]~~ provides that at least one of the terminals be connected directly or via a digital transmission link to the digital data network, with the result that the data need not first be coded by the
30 terminal for transmission in the voice connection path and then decoded again.

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The method according to the present invention ~~[is]~~ may be implemented in a data network which is ~~[a generally accessible]~~ an individual data network or which is made up of an interconnection of a plurality of ~~[generally accessible]~~ individual data networks.

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~~[It is further provided that the useful]~~ The user information to be transmitted may in an embodiment of the method according to the present invention conform to the features of FAX class 3.

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~~[Finally, a further development]~~ In another embodiment of the method according to the present invention ~~[is characterized in that]~~, using cryptographic processes~~[,]~~ the ~~[useful]~~ user information in the digital data network is protected against passive monitoring, alteration and/or simulation of incorrect call data and/or contents.

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The ~~[above-indicated method and its further developments permit]~~ method according to the present invention permits what is not possible with the previously known methods, namely, to dispose the devices required for conversion at central locations of the data network and, therefore, not to have to provide such a conversion at every transition from a conventional voice connection path and a digital data network.

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Consequently, it ~~[is]~~ may be of great advantage that, according to the problem of bandwidth reduction solved by the present invention, the long-distance transmission of the ~~[useful]~~ user information now requires only the bandwidth which the terminal actually requires for the transmission of the information. In the case of a FAX Group 3 connection at the presently customary 14400 bit/s, therefore, only slightly more than 14400 bit/s is actually required for transmission, instead of the usual 64 kbit/s (e.g. in the ISDN D-channel), for coding in the voice channel. This corresponds approximately to a reduction of the required bandwidth to 1/4 of the original capacity. The digital transmission of the ~~[useful]~~ user information over any data network can be so integrated into the connection that the participating terminals are unable to detect

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whether the transmission is being effected completely via a voice connection path or whether the transmission is being effected partially via an independent data network. This also ensures that, as is generally customary in the case of FAX services, the successful termination of the connection is acknowledged.

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It may be that the use of data networks for the delayed forwarding of the ~~[useful]~~ information ~~[is also known]~~ has been used when working with EDP-supported switching of FAX information; there, however, the FAX switching represents an end point for the acknowledged FAX transmission and is not used for the transparent transmission of the FAX information. Consequently, in contrast to ~~[the]~~ a method according to the present invention, a true end-to-end acknowledgment of the successful transmission of the FAX information is then not possible.

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A further advantage of the present invention can be seen in that, in contrast to the already known use of data networks for the real-time transmission of FAX information, the ~~[claimed method]~~ method according to the present invention can be implemented significantly more cost-effectively. Thus, ~~[with this method]~~ using the present invention, the conversion from data modulation in the voice connection path to data transmission in the data network can be effected at a central location of the data network. Consequently, depending on the limiting condition, it is possible to decide individually for each connection whether, for one or more sections, data transmission in the voice connection path is to be converted or not. In the case of connections using only transmission links having sufficiently great transmission reserves, the more cost-effective solution might be to transmit the data in the voice connection path routed via a data network, without additional conversion. If, however, long sections have to be routed over heavily loaded transmission links of the data network, then the data transmission conversion implemented by the method according to the present invention can significantly reduce the data rate on the heavily loaded sections.

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Brief Description of the Drawings

Hereinbelow, the present invention is ~~[described in greater detail]~~ elaborated upon on the basis of ~~[an exemplary embodiment clarified by]~~ the drawings, in which:

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- Figure 1 shows a schematic representation of ~~[the known]~~ a prior art basic structure of data transmission in voice connection paths, including a graphical representation of the required transmission bandwidth;
- Figure 2 shows a schematic representation of a ~~[known]~~ prior art method for a service-specific utilization of a data network, including a graphical representation of the required transmission bandwidth;
- Figure 3 shows a schematic representation of an embodiment of the method according to the present invention, including a graphical representation of the required transmission bandwidth;
- Figure 4 shows a simplified schematic representation of information transmission; and
- Figure 5 shows a simplified schematic representation ~~[of an example]~~ of a network implemented ~~[according to the method of the]~~ in accordance with an embodiment of the method according to present invention.

Detailed Description

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Figure 1 shows ~~[the]~~ a schematic representation of a prior art basic structure of data transmission in voice connection paths. The two terminals 1 are connected via an access line ASL to ~~[an exchange]~~ one of a plurality of exchanges 2. These exchanges are interconnected via voice connection paths ÜST. In order to set up a connection, usually one of the two terminals 1 sends its destination information to the corresponding exchange 2 which thereupon sets up a voice connection path ÜST between the two terminals 1. Owing to their technical construction, both terminals 1 are capable of coding the data for transmission in such a manner that it can be transmitted via a voice connection path. Such coding is based normally on multi-frequency tone signals of the kind known, for example, from multi-frequency tone dialing~~[, as well]~~.

Usually, at the beginning of the connection, both terminals 1 test the characteristics of the voice connection path ÜST and of their own device type, in order then to agree interactively on a transmission method which makes optimal use of the voice connection path. However, in determining the transmission method, it is virtually irrelevant how the individual transmission links ASL, ÜST and exchanges 2 involved in the connection are actually technically implemented, i.e., whether, for example, the transmission and switching in a certain section are analog or digital.

To illustrate the transmission bandwidth required in the individual sections ASL, ÜST of the transmission link, the transmission bandwidth actually required in each case is shown below the end-to-end connection in the bottom part of Figure 1, and likewise in Figures 2 and 3; in the example shown in Figure 1, an exclusively digital transmission method and digital switching for the voice connection path have been assumed.

Figure 2 shows a known transmission method for FAX information. As already described in connection with Figure 1, terminal 1 sends data via a voice connection path which is made available by way of its access line ASL and assigned exchange 2.

Unlike in the straight-through voice connection path shown in Figure 1, a data network 4 is used for transmitting the ~~[useful]~~ user information. At transition 3 into data network 4, the voice connection path is terminated and the data transmitted therein is routed directly via data network 4 to assigned transition 3, from where data is then transmitted again via a voice connection path.

In this connection, however, it should be mentioned that, within data network 4, the bandwidth required for information transmission is only slightly higher than the ~~[useful]~~ user information sent by the terminal, as is indicated in the bottom part of Figure 2, as well. However, it should also be emphasized that, in this example, the voice connection path is not routed via data network 4, but is terminated at transition 3 and is ~~[regenerated]~~ newly generated, so that in none of the transmission-path sections

used here is the voice connection path transmitted via a digital data network,
something which is, however, ~~[essential]~~ needed for ~~[the]~~ a method according to the
present invention as described in the following, because ~~[the]~~ an object ~~[is, after all,]~~ of
the present invention is to save on transmission bandwidth during transmission via a
5 digital data network.

~~[The]~~ In an embodiment of the method ~~[of]~~ according to the present invention~~[(see~~
Claim 2) can be implemented particularly advantageously if], for the transition from
the voice connection path to the data network, use is advantageously made not of
10 special modems adapted to the type of voice transmission, but of the normal telephone
gateways for voice traffic.

The actual transition from data transmission in the voice connection path to
transmission in the digital data network may advantageously take place at several
15 central locations in the data network, as roughly indicated in Figure 5. Thus, the
transition between transmission in the digitally routed voice connection path and data
transport in the data network can be flexibly realized, and the voice connection paths
can be connected to the data network by already existing devices which need not be
modified to suit the method according to the present invention.

~~[The]~~ An embodiment of the method ~~[of]~~ according to the present invention is ~~[best]~~
illustrated in Figure 3. A voice connection path begins at a terminal 1 and, as also in
the two previously described prior methods, is routed via an access line ASL and one
or (not shown) more exchanges 2. In contrast to the known method shown in Figure 2,
25 in this case the voice connection path is not terminated at a transition 5 to a data
network 4, but the entire voice connection path, including the ~~[useful]~~ user information
modulated therein, is routed in data network 4. The slightly greater bandwidth
requirement in comparison with the pure voice connection path results from the
additional control information which is always required in a data network. The method
30 according to the present invention can be employed within this routing of the voice

connection path in the data network, and the ~~[useful]~~ user information modulated in the voice connection path can be converted at transition 6 between the end of one data network 4 and the start of the next data network 7 used for transmission, and can be transmitted directly over the aforementioned next data network 7.

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In ~~[a further]~~ an embodiment, the method ~~[of]~~ according to the present invention can be integrated particularly simply into an existing data network if the inclusion of the data network in the voice connection path used for data transmission, as well as the inclusion of transmission sections operated using the method according to the present invention, are accomplished automatically by context-related call-number translation.

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Call-number translation is possible either if the terminal setting up the connection also sends an identifier for the desired service, e.g., FAX, or if information concerning which access line will be used exclusively for data transmission in the voice connection path is stored in the exchange assigned to the terminal. In this case, no special call number needs to be dialed when setting up the connection to ensure that data transmission in the voice connection path is replaced by data transmission in the data network. This is accomplished automatically by the aforementioned call-number translation in the telecommunications network.

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~~[Another]~~ A problem ~~[relates]~~ relating to the acknowledgment of the transmitted data, ~~this problem being~~ may be solved by ~~[a further]~~ another embodiment of the method according to the present invention ~~[(see Claim 4)]~~. Namely, when data is transmitted via a voice connection path, only an end-to-end acknowledgment of the transmitted data can be carried out ~~[for principle-inherent reasons]~~. This results in the disadvantage that, in the event of a faulty transmission of the data, the transmission must be repeated over the entire transmission link. Owing to the section-wise transmission and acknowledgment of the data according to the present invention, the transmission of the data only has to be repeated over the section in which the error actually occurred. Figure 4 shows an example of one possible practical

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implementation, by which the net data transmission rate is likewise improved.

After the voice connection path has been set up between terminal 1 and transition 5 (effected by a modem) between a data ~~[(useful)]~~ (user information) transmission in the voice connection path and a data transmission in the digital data network, the sender identification of terminal 1 is transmitted. For this purpose, it is not necessary that the connection to the other terminal 1 already be completely established. Namely, as soon as the connection sections to the receiving terminal have been set up, the sender identification is transmitted over these sections of the transmission link. Similarly, as shown in Figure 4, the receiver identification is then transmitted in the reverse direction to the sending terminal. The ~~[(useful)]~~ user information is subsequently transmitted and acknowledged section-by-section. The final confirmation of successful transmission is then sent again directly from the receiving terminal to the sending terminal.

Since the technical parameters of the two terminals are not necessarily identical or do not have to be identical, it is ~~[(obvious)]~~ apparent that different technical methods ~~[(with)]~~ may be employed on the respective voice connection paths. Thus, it is possible for the two terminals to send and receive at different bit rates. According to the present invention~~[(see Claim 5)]~~, this problem is solved in that, at transitions 6 between data transmission in voice connection path 4 and data transmission in digital data network 7, the ~~[(useful)]~~ user data is temporarily stored for a brief time (depending on the speed difference to be compensated) for the purpose of speed matching and, if applicable, time gaps in the data stream are picked up by appropriate signaling.

Since in the case of data transmission in the voice connection path, the maximum possible transmission rate is not always required during the entire duration of the connection, ~~[(according to)]~~ in a further embodiment of ~~[(the)]~~ a method according to the present invention~~[(see Claim 6)]~~, the data transfer in digital data network 7 ~~[(is advantageously not)]~~ may be effected at a non-constant bit rate~~[(, but is)]~~ and be flexibly

adapted to the instantaneous requirements.

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5 If ~~the~~ a method ~~of~~ according to the present invention for bandwidth reduction in voice connection paths is applied to the transmission of ~~useful~~ user information according to FAX class 3~~(see Claim 9)~~, particular efficiency is achieved ~~if~~ when FAX messages are sent over long distances. Through the arrangement of transitions from FAX transmission in the voice connection path to FAX transmission in a data network available worldwide, such as the Internet or an X.25 network, it is possible to transmit the FAX message over expensive long-distance links at correspondingly
10 reduced bit rate via a data network, while the message is distributed geographically from the transitions to the end user via standard voice connection paths which can be implemented using both conventional techniques and with the aid of digital data networks. It would be sufficient, for example, if in each case one of these transitions were installed in Moscow, Frankfurt, (as shown in Figure 5), New York and Tokyo.
15 For a large proportion of international FAX traffic, it would then no longer be necessary for the data to be transmitted in the voice connection path on intercontinental links.

20 Instead of establishing a new worldwide data network for the purpose of reducing bandwidth when transmitting data in the voice connection path, it is possible ~~(see Claim 8)~~ to utilize the existing ~~Internet~~ INTERNET for this purpose.

25 The bottom part of Figure 3 ~~impressively~~ shows how bandwidth is saved on the expensive long-distance links which are implemented by digital data networks 7.

Since, however, there can be no guarantee in the ~~Internet~~ INTERNET that the data transmitted therein will not be subject to unauthorized access, encryption by cryptographic processes ~~is advisable (see Claim 10)~~ may be employed. In the event that a computer or intelligent terminal is to be employed as a terminal, it is possible,
30 using the appropriate software, to connect the computer or intelligent terminal directly

to the digital data network~~[(see Claim 7)]~~. In this manner, using any personal computer (PC) connected to the ~~[Internet]~~ INTERNET, it is possible, for example, to send a FAX message to a Group 3 terminal without this requiring any special adaptation of the participating hardware.

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Revised Specification Pages 1-5, 5a, 5b

METHOD FOR USING DIGITAL DATA NETWORKS FOR THE PURPOSE
OF REDUCING BANDWIDTH WHEN TRANSMITTING DATA
OVER VOICE CONNECTION PATHS

The invention relates to a method for using digital data networks according to the preamble of Claim 1.

5 For the purpose of data transmission, communication networks exist which are used exclusively for transmitting digitally coded data (data, voice, tone signals, images) between terminals, and which have been suitably optimized for this application purpose.

10 Owing to the limited worldwide availability of such networks, even today a multitude of data is still transmitted over analog voice connection paths. In this case, modulators and demodulators (MODEMs) are used to adapt the binary-coded data to the analog transmission characteristics of the voice connection paths.

15 As a result of the growth of data networks, especially of the data network known as the INTERNET for the worldwide interconnection of computer networks, methods have also become established which transmit speech in coded form over data networks. Due to the now far-advanced digitization of analog telecommunications networks, hardly any pure analog, i.e. exclusively analog, voice connection paths remain. Today, generally only the subscriber access line is operated in analog manner, while the long-
20 distance transmission of the voice information is carried out using digital transmission methods. Normally, a transmission rate of 64 kbit/s is used in telecommunications networks for an analog voice transmission path standardized according to CCITT (Comité Consultative International Télégraphique et Téléphonique - International Advisory Committee for Telegraph and Telephone Services). The most well known

systems for wire-bound voice transmission are PDH (Plesiosynchronous Digital Hierarchy - standardized system for digital data transmission), SDH (Synchronous Digital Hierarchy -international standard for synchronous transmission networks) and ATM (Asynchronous Transfer Mode - digital transmission method, e.g., for broadband ISDN, in which the entire capacity of a transmission channel is split, depending on demand and time, between a few or many connections which then use the channel jointly). For wireless transmission of speech in mobile communication networks, use is made of the DECT standard (Digital Enhanced (European) Cordless Telecommunication - uniform digital standard for cordless telephones, wireless telecommunications systems and wireless LANs in Europe) as well as of the GSM standard (Global Systems for Mobile Communication - worldwide mobile communication standard for digital, cellular mobile communication networks). Likewise, there has recently been discussion about voice transmission over the Internet, as indicated in the magazine iX in August 1997, page 32.

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be directly connected to the multifunctional network, and that both terminals have been technically prepared for this type of data transmission.

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5 Another method, described in a study "Requirements for Internet Fax" by Larray
Masinter from the Xerox Corp. in "Application Area INTERNET-DRAFT", dated
Nov. 4, 1997, pages 1 to 4, employs a digital network to transmit the originally
analog-modulated information in digital form between two converting modems which,
functionally, must be disposed directly at the transition into the data network.

10

All these known methods suffer from the serious disadvantage that they are limited
only to the transition between various services and to the conversion of individual
services handled via a voice connection in the voice connection path.

15 **WO 97/47107** discloses a method and a device for connecting a fax machine to a
digital communication network. In order to be able to transmit a fax message from
one fax machine to another using digital communication, an interface which converts
the fax message to be transmitted into an image data file is allocated to each fax
machine. The image data file is subsequently transmitted via an analog line or an
20 ISDN line of a public, circuit-switched network or a private telephone line to a server.
In the server, the image data file is embedded into a data file and is supplied to a data
path of a **data network**.

25 Therefore, the design approach of the present invention is to indicate a solution for
eliminating the problems, discussed extensively above, with regard to the transmission
bandwidth of known methods which make no contribution to reducing the transmission
paths used for transmitting useful information.

30 The problem of reducing bandwidth when transmitting data over voice connection
paths routed in a digital data network is solved by the invention, in that both the

5 sending and the receiving terminals use a generally identical method for the
transmission of data in voice connection paths, but the useful information to be
transmitted is transported in one or more sections via a data network, the modulation
method specified by the terminal not being used over the entire transmission link in
direct manner via one or more switching nodes or in indirect manner via a data
network, but rather **a conversion of the coding of the useful information between
the data transmission in the digitally transmitting voice connection path and the
data transmission in the digital data network is first carried out within data
network (4), so that on some sections of data network (4), the useful information is
transmitted via the coded voice connection path, and on the other sections of data
network (4), the useful information is transmitted** by a method suitable for digital
data networks, it further being the case that there is no need for functional matching of
the terminals or for the terminals to be adapted to the transmission characteristics of
the digital data network for the transmission of the useful information.

15 ~~As regards the embodiment of this method, the conversion (matching) of the coding of
the useful data in the digitally transmitting voice connection path and the data
transmission in the digital data network are carried out only within the data network, so
that on some line sections of the data network, the useful information is transmitted via
the coded voice connection path, and on the other line sections of the data network, the
useful information is transmitted directly according to the methods of the data network.~~

25 According to a further embodiment of the method of the present invention, the
inclusion of a digital data network in the voice connection path used for data
transmission is effected automatically by a context-related call-number translation
during the connection setup, this not being perceived by the terminals using the voice
connection path.

30 Furthermore, the digital data network is included in the voice connection path used for
voice transmission in such a way that the end-to-end signaling of the terminals,

required for the control of...

(The Specification is continued on Page 6 of the original document with "data transport...")

packets for its transmission over the digital data network, and thus to be flexibly adapted to the bit rate actually being transmitted by the terminal.

The invention further proposes that at least one of the terminals be connected directly or via a digital transmission link to the digital data network, with the result that the data need not first be coded by the terminal for transmission in the voice connection path and then decoded again.

The method according to the present invention is implemented in a data network which is a generally accessible data network or which is made up of an interconnection of a plurality of generally accessible data networks.

It is further provided that the useful information to be transmitted conform to the features of FAX class 3.

Finally, a further development of the method according to the present invention is characterized in that, using cryptographic processes, the useful information in the digital data network is protected against passive monitoring, alteration and/or simulation of incorrect call data and/or contents.

The above-indicated method and its further developments permit what is not possible with the previously known methods, namely, to dispose the devices required for conversion at central locations of the data network and, therefore, not to have to provide such a conversion at every transition from a conventional voice connection path and a digital data network.

Consequently, it is of great advantage that, according to the problem of bandwidth reduction solved by the invention, the long-distance transmission of the useful information now requires only the bandwidth which the terminal actually requires for the transmission of the information. In the case of a FAX Group 3 connection at the

presently customary 14400 bit/s, therefore, only slightly more than 14400 bit/s is actually required for transmission, instead of the usual 64 kbit/s (e.g. in the ISDN D-channel), for coding in the voice channel. This corresponds approximately to a reduction of the required bandwidth to 1/4 of the original capacity. The digital transmission of the useful information over any data network can be so integrated into the connection that the participating terminals are unable to detect whether the transmission is being effected completely via a voice connection path or whether the transmission is being effected partially via an independent data network. This also ensures that, as is generally customary in the case of FAX services, the successful termination of the connection is acknowledged.

It may be that the use of data networks for the delayed forwarding of the useful information is also known when working with EDP-supported switching of FAX information; there, however, the FAX switching represents an end point for the acknowledged FAX transmission and is not used for the transparent transmission of the FAX information. Consequently, in contrast to the invention, a true end-to-end acknowledgment of the successful transmission of the FAX information is not possible.

A further advantage of the present invention can be seen in that, in contrast to the already known use of data networks for the real-time transmission of FAX information, the claimed method can be implemented significantly more cost-effectively. Thus, with this method, the conversion from data modulation in the voice connection path to data transmission in the data network can be effected at a central location of the data network. Consequently, depending on the limiting condition, it is possible to decide individually for each connection whether, for one or more sections, data transmission in the voice connection path is to be converted or not. In the case of connections using only transmission links having sufficiently great transmission reserves, the more cost-effective solution might be to transmit the data in the voice connection path routed via a data network, without additional conversion. If, however, long sections have to be

routed over heavily loaded transmission links of the data network, then the data transmission conversion implemented by the method according to the present invention can significantly reduce the data rate on the heavily loaded sections.

5 Hereinbelow, the invention is described in greater detail on the basis of an exemplary embodiment clarified by the drawings, in which:

Figure 1 shows a schematic representation of the known basic structure of data transmission in voice connection paths;

10 Figure 2 shows a schematic representation of a known method for a service-specific utilization of a data network;

Figure 3 shows a schematic representation of the method according to the present invention;

Figure 4 shows a simplified representation of information transmission; and

15 Figure 5 shows a simplified representation of an example of a network implemented according to the method of the present invention.

Figure 1 shows the basic structure of data transmission in voice connection paths. The two terminals 1 are connected via an access line ASL to an exchange 2. These exchanges are interconnected via voice connection paths ÜST. In order to set up a connection, usually one of the two terminals 1 sends its destination information to the corresponding exchange 2 which thereupon sets up a voice connection path ÜST between the two terminals 1. Owing to their technical construction, both terminals 1 are capable of coding the data for transmission in such a manner that it can be transmitted via a voice connection path. Such coding is based normally on multi-frequency tone signals of the kind known, for example, from multi-frequency tone dialing, as well.

20

25

Usually, at the beginning of the connection, both terminals 1 test the characteristics of the voice connection path ÜST and of their own device type, in order then to agree interactively on a transmission method which makes optimal use of the voice

30

connection path. However, in determining the transmission method, it is virtually irrelevant how the individual transmission links ASL, ÜST and exchanges 2 involved in the connection are actually technically implemented, i.e., whether, for example, the transmission and switching in a certain section are analog or digital.

5

To illustrate the transmission bandwidth required in the individual sections ASL, ÜST of the transmission link, the transmission bandwidth actually required in each case is shown below the end-to-end connection in the bottom part of Figure 1, and likewise in Figures 2 and 3; in the example shown in Figure 1, an exclusively digital transmission method and digital switching for the voice connection path have been assumed.

10

Figure 2 shows a known transmission method for FAX information. As already described in connection with Figure 1, terminal 1 sends data via a voice connection path which is made available by way of its access line ASL and assigned exchange 2.

15

Unlike in the straight-through voice connection path shown in Figure 1, a data network 4 is used for transmitting the useful information. At transition 3 into data network 4, the voice connection path is terminated and the data transmitted therein is routed directly via data network 4 to assigned transition 3, from where data is then transmitted again via a voice connection path.

20

In this connection, however, it should be mentioned that, within data network 4, the bandwidth required for information transmission is only slightly higher than the useful information sent by the terminal, as is indicated in the bottom part of Figure 2, as well.

25

However, it should also be emphasized that, in this example, the voice connection path is not routed via data network 4, but is terminated at transition 3 and is regenerated, so that in none of the transmission-path sections used here is the voice connection path transmitted via a digital data network, something which is, however, essential for the method according to the present invention described in the following, because the object is, after all, to save on transmission bandwidth during transmission via a digital

30

data network.

The method of the present invention (see Claim 2) can be implemented particularly advantageously if, for the transition from the voice connection path to the data
5 network, use is made not of special modems adapted to the type of voice transmission, but of the normal telephone gateways for voice traffic.

The actual transition from data transmission in the voice connection path to transmission in the digital data network may advantageously take place at several
10 central locations in the data network, as roughly indicated in Figure 5. Thus, the transition between transmission in the digitally routed voice connection path and data transport in the data network can be flexibly realized, and the voice connection paths can be connected to the data network by already existing devices which need not be modified to suit the method according to the invention.

The method of the present invention is best illustrated in Figure 3. A voice connection path begins at a terminal 1 and, as also in the two previously described methods, is routed via an access line ASL and one or (not shown) more exchanges 2. In contrast to the known method shown in Figure 2, in this case the voice connection path is not
15 terminated at a transition 5 to a data network 4, but the entire voice connection path, including the useful information modulated therein, is routed in data network 4. The slightly greater bandwidth requirement in comparison with the pure voice connection path results from the additional control information which is always required in a data network. The method according to the invention can be employed within this routing
20 of the voice connection path in the data network, and the useful information modulated in the voice connection path can be converted at transition 6 between the end of one data network 4 and the start of the next data network 7 used for transmission, and can be transmitted directly over the aforementioned next data network 7.

In a further embodiment, the method of the present invention can be integrated particularly simply into an existing data network if the inclusion of the data network in the voice connection path used for data transmission, as well as the inclusion of transmission sections operated using the method according to the invention, are accomplished automatically by context-related call-number translation.

Call-number translation is possible either if the terminal setting up the connection also sends an identifier for the desired service, e.g. FAX, or if information concerning which access line will be used exclusively for data transmission in the voice connection path is stored in the exchange assigned to the terminal. In this case, no special call number needs to be dialed when setting up the connection to ensure that data transmission in the voice connection path is replaced by data transmission in the data network. This is accomplished automatically by the aforementioned call-number translation in the telecommunications network.

Another problem relates to the acknowledgment of the transmitted data, this problem being solved by a further embodiment of the invention (see Claim 4). Namely, when data is transmitted via a voice connection path, only an end-to-end acknowledgment of the transmitted data can be carried out for principle-inherent reasons. This results in the disadvantage that, in the event of a faulty transmission of the data, the transmission must be repeated over the entire transmission link. Owing to the section-wise transmission and acknowledgment of the data, the transmission of the data only has to be repeated over the section in which the error actually occurred. Figure 4 shows an example of one possible practical implementation, by which the net data transmission rate is likewise improved.

After the voice connection path has been set up between terminal 1 and transition 5 (effected by a modem) between a data (useful information) transmission in the voice connection path and a data transmission in the digital data network, the sender identification of terminal 1 is transmitted. For this purpose, it is not necessary that the

connection to the other terminal 1 already be completely established. Namely, as soon as the connection sections to the receiving terminal have been set up, the sender identification is transmitted over these sections of the transmission link. Similarly, as shown in Figure 4, the receiver identification is then transmitted in the reverse direction to the sending terminal. The useful information is subsequently transmitted and acknowledged section-by-section. The final confirmation of successful transmission is then sent again directly from the receiving terminal to the sending terminal.

Since the technical parameters of the two terminals are not necessarily identical or do not have to be identical, it is obvious that different technical methods will be employed on the respective voice connection paths. Thus, it is possible for the two terminals to send and receive at different bit rates. According to the invention (see Claim 5), this problem is solved in that, at transitions 6 between data transmission in voice connection path 4 and data transmission in digital data network 7, the useful data is temporarily stored for a brief time (depending on the speed difference to be compensated) for the purpose of speed matching and, if applicable, time gaps in the data stream are picked up by appropriate signaling.

Since in the case of data transmission in the voice connection path, the maximum possible transmission rate is not always required during the entire duration of the connection, according to a further embodiment of the invention (see Claim 6), the data transfer in digital data network 7 is advantageously not effected at a constant bit rate, but is flexibly adapted to the instantaneous requirements.

If the method of the present invention for bandwidth reduction in voice connection paths is applied to the transmission of useful information according to FAX class 3 (see Claim 9), particular efficiency is achieved if FAX messages are sent over long distances. Through the arrangement of transitions from FAX transmission in the voice connection path to FAX transmission in a data network available worldwide, such as

the Internet or an X.25 network, it is possible to transmit the FAX message over expensive long-distance links at correspondingly reduced bit rate via a data network, while the message is distributed geographically from the transitions to the end user via standard voice connection paths which can be implemented using both conventional techniques and with the aid of digital data networks. It would be sufficient, for example, if in each case one of these transitions were installed in Moscow, Frankfurt, (as shown in Figure 5), New York and Tokyo. For a large proportion of international FAX traffic, it would then no longer be necessary for the data to be transmitted in the voice connection path on intercontinental links.

Instead of establishing a new worldwide data network for the purpose of reducing bandwidth when transmitting data in the voice connection path, it is possible (see Claim 8) to utilize the existing Internet for this purpose.

The bottom part of Figure 3 impressively shows how bandwidth is saved on the expensive long-distance links which are implemented by digital data networks 7.

Since, however, there can be no guarantee in the Internet that the data transmitted therein will not be subject to unauthorized access, encryption by cryptographic processes is advisable (see Claim 10). In the event that a computer or intelligent terminal is to be employed as a terminal, it is possible, using the appropriate software, to connect the computer or intelligent terminal directly to the digital data network (see Claim 7). In this manner, using any personal computer (PC) connected to the Internet, it is possible, for example, to send a FAX message to a Group 3 terminal without this requiring any adaptation of the participating hardware.

Patent Claims

1. A method for reducing bandwidth when transmitting data over voice connection paths that are routed at least section-wise in a digital data network (4), characterized in that both the sending and the receiving terminals (1) use a generally identical method for transmitting data in voice connection paths, but the useful information to be transmitted is transported in one or more sections via a data network (4, 7), the modulation method specified by the terminal (1) not being used over the entire transmission link in direct manner via one or more switching nodes (2) or in indirect manner via a data network (4), but rather the transmission in the digital data network (7) being effected by a method suitable for digital data networks; it further being the case that there is no need for a functional matching of the terminals (1) or for the terminals (1) to be adapted to the transmission characteristics of the digital data network for the transmission of the useful information.

2. The method as recited in Claim 1, characterized in that the conversion (matching) of the coding of the useful data between data transmission in the digitally transmitting voice connection path and data transmission in the digital data network is performed only at the transitions (6) to and from the digital network (7), so that over some line sections of the data network, the useful information is transmitted via the coded voice connection path of the data network (4), and over the other line sections of the data network, is transmitted directly according to the methods of the other data network (7).

Patent Claims

1. A method for reducing bandwidth when transmitting data over voice connection paths that are routed at least sections-wise in a digital data network (4), ~~characterized in that~~ **where** both the sending and the receiving terminals (1) use a generally identical **modulation** method for transmitting data in voice connection paths, but the useful information to be transmitted is transported in one or more sections via a data network (4, 7), the modulation method specified by the terminal (1) not being used over the entire transmission link in direct manner via one or more switching nodes (2) or in indirect manner via a data network (4), but rather **a conversion of the coding of the useful information between the data transmission in the digitally transmitting voice connection path and the data transmission in the digital data network first being carried out within the data network (4), so that on some sections of the data network (4), the useful information is transmitted via the coded voice connection path, and on the other sections of the data network (4), the useful information is transmitted** ~~transmission in the digital data network (7) being effected~~ by a method suitable for digital data networks; it further being the case that there is no need for a functional matching of the terminals (1) or for the terminals (1) to be adapted to the transmission characteristics of the digital data network for the transmission of the useful information.

2. The method as recited in Claim 1, characterized in that the inclusion of a digital data network (7) in the voice connection path used for data transmission is effected automatically by a context-related call-number translation during the connection setup, this not being perceived by the terminals (1) using the voice connection path.

3. The method as recited in Claim 2, characterized in that the inclusion of the digital data network (7) in the voice connection path used for data transmission is effected, such that the end-to-end

signaling of the terminals (1), which is required for the control of the data transport, is terminated at the transition (6) into the digital data network (7) used for the transmission and is regenerated in order to thus integrate the control of the data transport by the digital network into this end-to-end signaling.

4. The method as recited in one or more of Claims 1 through 3, characterized in that, to match different methods used by the terminals (1) for data transmission, suitable temporary storage and conversion of the transmitted data and signaling information are carried out, the terminals (1) involved in the data transmission not being aware of the use of different transmission methods.

5. The method as recited in one or more of Claims 1 through 4, characterized in that the useful information is split into individual data packets for its transmission over the digital data network (7), the transmission rate of the packets being flexibly adapted at the network transitions (6) to the bit rate actually being transmitted by the terminal (1).

6. The method as recited in one or more of Claims 1 through 5, characterized in that at least one of the terminals (1) is connected directly or via a digital transmission link to the digital data network, so that the data need not first be coded by the terminal (1) for its transmission in the voice connection path and then decoded again.

7. The method as recited in one or more of Claims 1 through 6, characterized in that the method is implemented in a data network which is a generally accessible data network or is made up of an interconnection of a plurality of generally accessible data networks.

8. The method as recited in one or more of Claims 1 through 7, characterized in that the useful information to be transmitted conforms to the features

of FAX class 3.

9. The method as recited in one or more of Claims 1 through 8k, characterized in that, before being transmitted in digital data networks (7), the useful information is protected by cryptographic processes against passive monitoring, alteration and/or simulation of incorrect call data and/or contents.

Abstract

Voice connection paths exist both in analog telephone networks and, more recently, in digital data networks, the voice information being digitized and transmitted in real time over the data network.

5 However, the voice connection paths are used not only for transmitting speech, but also - given appropriate coding based on analog processes - for transmitting data, e.g. FAX information. Because this FAX information, present in the form of image data, is first converted into audio frequencies in the telephone band (300 - 3600 Hz), and thereafter these tones have to be digitized for transmission over the data network, there is a loss
10 of bandwidth, since the bit rate to be transmitted over the digital data network is now higher than the bit rate at which, for example, the FAX machine supplies the information to the voice network.

The invention achieves a bandwidth reduction for these applications, in that both the
15 sending and the receiving terminals use an identical method for transmitting in voice connection paths, but the information to be transmitted is transported in one or more sections via a data network, the modulation method specified by the terminal not being used over the entire transmission link, but rather being effected in the digital data network by a method suitable for that purpose. The conversion of the coding of the
20 information between the data transmission in the digital voice connection path and transmission in the digital data network is first carried out within the data network, so that over some line sections of the data network, the information is transmitted via a coded voice connection path, and over other line sections of the data network, is transmitted using the coding processes of that network. This results in the actual
25 bandwidth reduction.

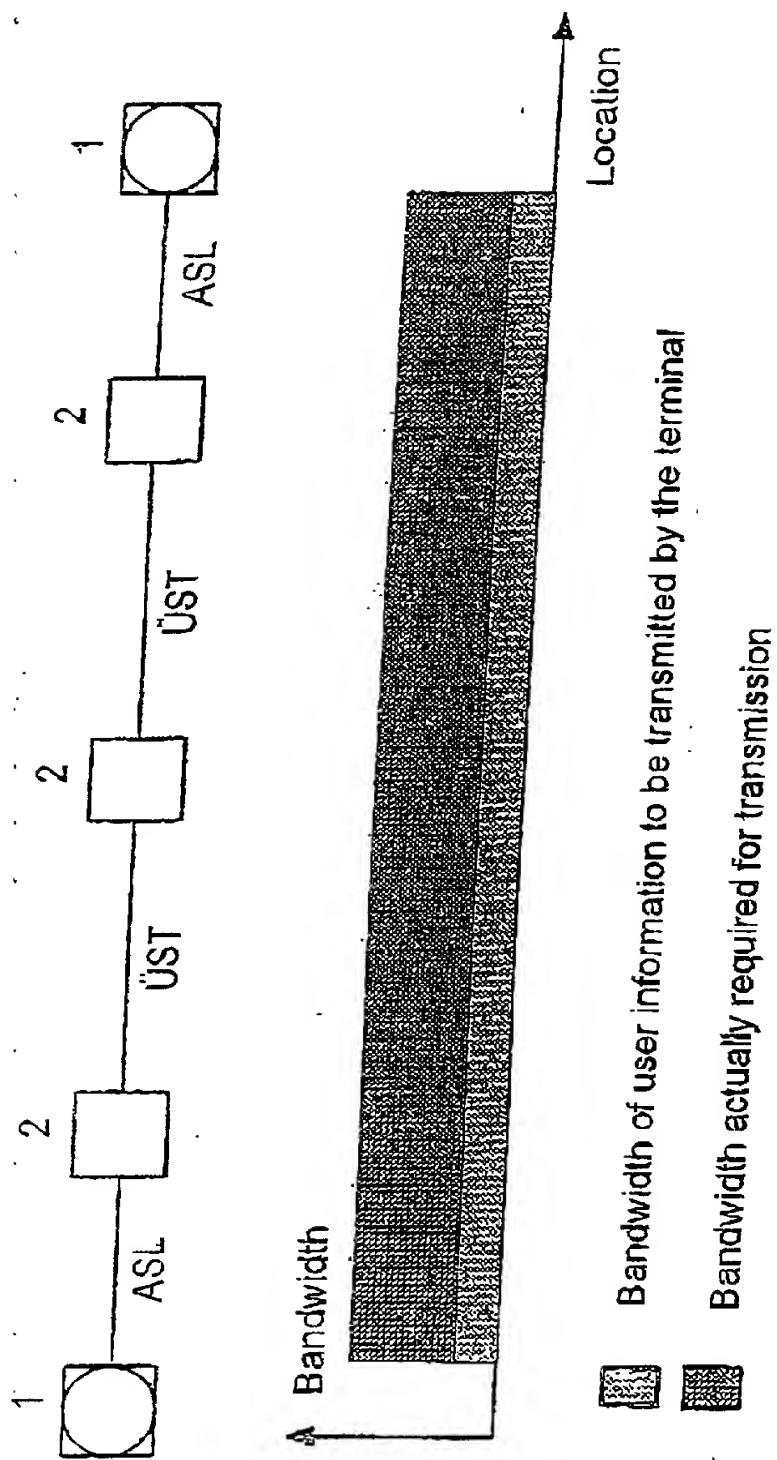


Fig. 1

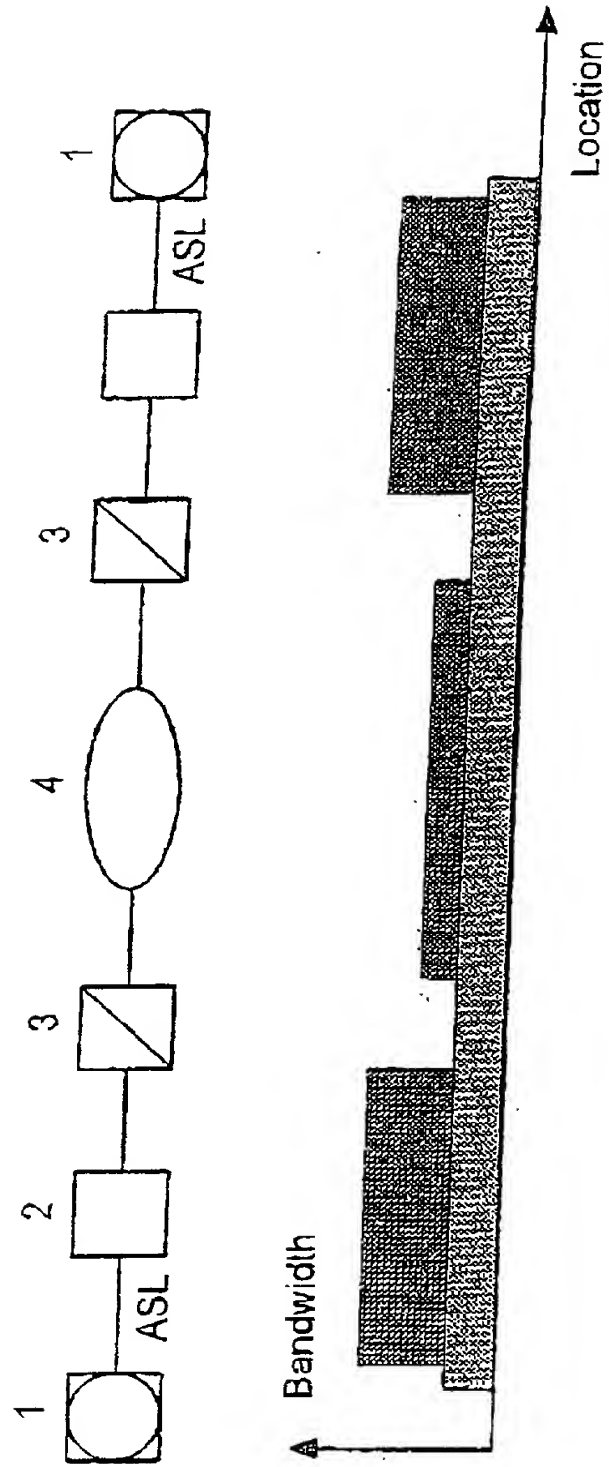


Fig. 2

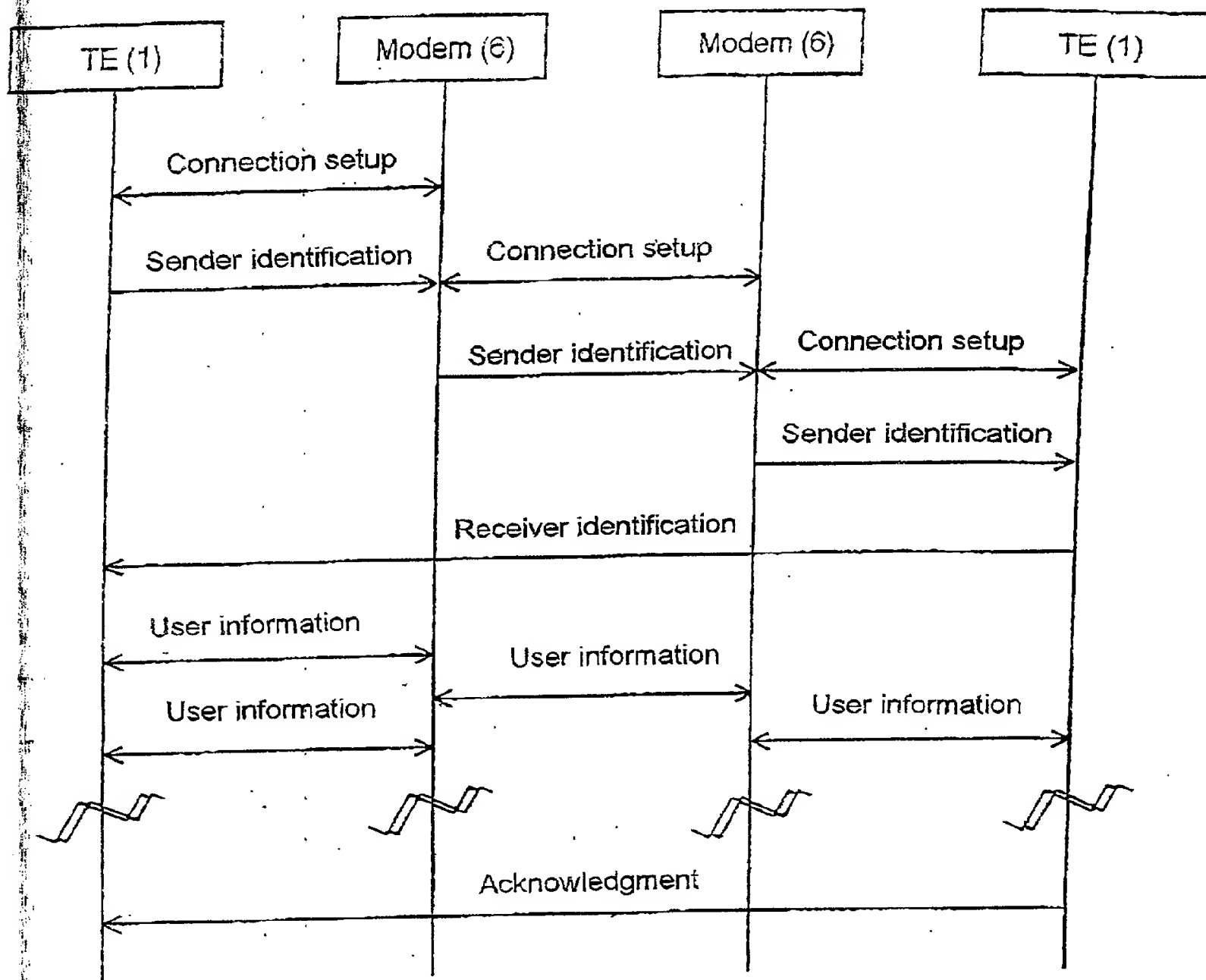


Fig. 4

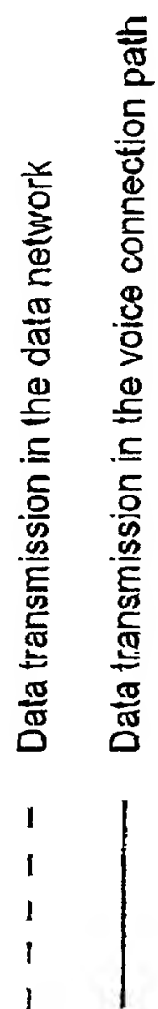


Fig. 5

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	
DECLARATION AND POWER OF ATTORNEY	ATTORNEY'S DOCKET NO. 2345/137

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name,

I believe I am an original, first, and joint inventor of the subject matter that is claimed and for which a patent is sought on the invention entitled **METHOD FOR UTILIZING DIGITAL DATA NETWORKS FOR THE TRANSMISSION OF DATA VIA VOICE CONNECTION PATHS**, the specification of which was filed as International Application No. **PCT/EP99/01284** on **27 February 1999**.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a).

PRIOR FOREIGN APPLICATION(S)

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)	PRIORITY CLAIMED UNDER 35 U.S.C. § 119
Germany	198 17 007.6	17 April 1998		YES

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I declare that all statements made herein of my own knowledge are true and all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under § 1001 of Title 18 of the United States Code and that such willful statements may jeopardize the validity of the application or any patent issuing thereon.

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<i>Klaus-Peter Zeffler</i>			<i>1st August 2000</i>

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	
DECLARATION AND POWER OF ATTORNEY	ATTORNEY'S DOCKET NO. 2345/137

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Signature 		Date 30.7.2000	
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POST OFFICE ADDRESS	POST OFFICE ADDRESS Randweg 44	CITY & ZIP CODE D-64297 Darmstadt	STATE OR FOREIGN COUNTRY Germany
Signature		Date	